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A real-time seismic and tsunami network in the Kyparissiakos Gulf, Greece

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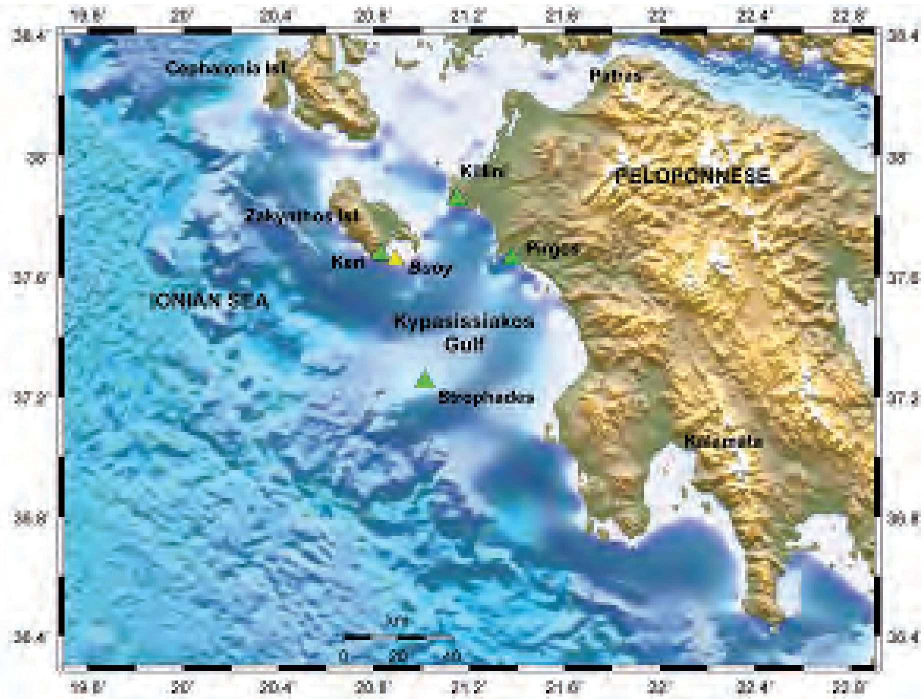
ABSTRACT A real-time on/offshore seismic and tsunami network was installed in the Kyparissiakos Gulf, south-western Greece, transmitting data by satellite and GPRS (mobile telephony) connection, and exploiting the Internet possibilities. The network consisted of one marine station for seismic and tsunami observations located offshore Zakynthos Island, three land stations at Killini, Pirgos and Keri-Zakynthos, transmitting data through mobile telephony, and one seismic station placed on the Island of Strophades that used a satellite link. The buoy and satellite stations were equipped with broadband 3C CME4011 seismic sensors of 30 s to 50 Hz, while all other locations used 3C refraction geophones of 4.5 Hz natural frequency. A high sensitivity pressure sensor for tsunami and tidal observations was attached to the marine seismic station at the seafloor. The marine real-time seismic and tsunami station originally developed for a microseismicity study in central Greece was further improved during the SEAHELLARC project. Transmitting data in a miniSEED format permits to integrate the stations to the National Seismograph Network of Greece. Data collection over several months has proved the efficiency of the system and the technology used proved to be economic in establishing and maintaining the stations, and of low operational costs.

Key words: real-time seismicity, on/offshore seismic networks, Kyparissiakos Gulf, Strophades, Greece, SEAHELLARC.

1. Introduction

Seismological networks are landlocked and bias the definition of the foci parameters of events located offshore (see: Hyndman and Rogers, 1981). Greece is a country with very high seismic activity associated, at a great extent, with numerous offshore faults. These are located far from the coasts, outside the National Seismograph Network of Greece, and are capable of generating large earthquakes and tsunamis that threaten the coastal communities. By deploying marine seismological stations we can improve the location accuracy of offshore events and reduce the detection threshold. A fairer azimuthal station distribution can also significantly improve the focal mechanism solutions and the definition of seismogenic zones. Thus the reliability of seismic hazard assessment at coastal and marine areas can be addressed with higher objectivity.

The problem in using ocean bottom seismographs (OBSs) is the lack of communication in real-time. Worldwide there are very few real-time marine seismological stations in operation, and these are costly and technically complicated (see: Favali *et al.*, 2002; NERIES FP6 EC Project, 2006; D'Anna *et al.*, 2008; Iannaccone *et al.*, 2010). In the following paper, we present a cost effective technical solution for real-time seismic and tsunami observations, originally developed in the frame of the AMPHITRITE project, supported by the General Secretariat of Research and Technology (GGET) of Greece, and improved during the European Community supported SEAHELLARC project (Papoulia *et al.*, 2014). The aim of SEAHELLARC was to develop a new approach in assessing seismic (Slejko *et al.*, 2014) and tsunami (Yalçiner *et al.*, 2014) hazard by exploiting new hardware and combining geological, geophysical and engineering studies. The coastal zone of western Peloponnese was used as a pilot area, since this margin is one of the most seismic and tectonic active regions of Europe. The "amphibious" SEAHELLARC array that will be described below consisted of three land stations, installed on Zakynthos Island and north-western Peloponnese, one marine seismic and tsunami station deployed offshore south Zakynthos, and one satellite seismic station located on the remote Island of Strophades (Fig. 1). Data were



Station Name	Location Name	Latitude	Longitude	Elevation-Depth (m)
Buoy	Zakynthos (Offshore Laganas Gulf)	37° 39.332′ N	20° 53.415′ E	-117.0
Pirgos	Lechena Village	37° 39.612′ N	21° 22.668′ E	6.0
Killini	Lygia Village	37° 51.426′ N	21° 08.946′ E	98.0
Keri	Zakynthos (Keri mountain)	37° 40.422′ N	20° 49.572′ E	336.0
Strophades	Strophades Island	37° 15.042′ N	21° 00.900′ E	10.0

Fig. 1 - The SEAHELLARC "amphibious" seismic and tsunami network (above). Green triangles mark land stations and the yellow one is the offshore station with seismic and tsunami capability. Locations and coordinates of the seismic stations (below).

transmitted through GPRS and satellite connection to an onshore base station located at the Hellenic Centre for Marine Research (HCMR), Athens. All land stations were equipped with SM6 type 4.5 Hz geophones. The marine seismic station and the Strophades satellite station used 3-C (three channels) broad band sensor (BBS) (30 s to 50 Hz). Data were recorded by the 6-C SEDIS V seismic recorder developed by GeoPro Hamburg (www.geopro.com). The marine seismic station was also equipped with a pressure sensor, which allows precise observations of sea level changes. Since the system is sensitive to very small pressure variations in the water column, it can be used to record tidal and tsunami waves. In the following we describe technical details of the seismic system deployed, and results of the seismicity observed in a 2-month period.

2. The SEDIS V seismic recorder

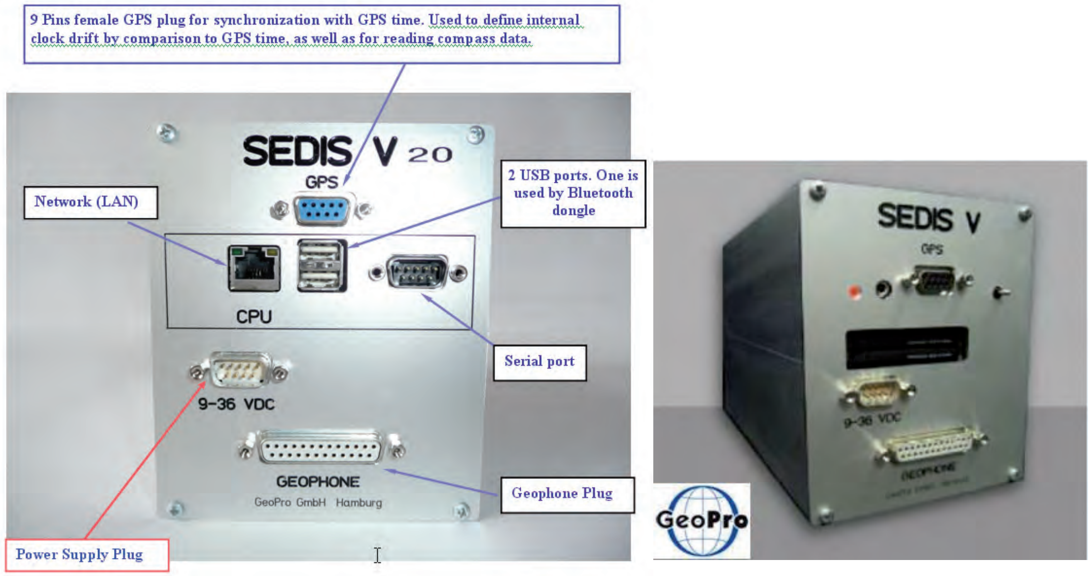
SEDIS V, previously developed by GeoPro Hamburg, is a lightweight seismic recorder offering various options for active and passive seismic observations. It consists of two main hardware parts: a 6-C digitizer, and a computer running Linux. Technical information on the main components of SEDIS V is given in Fig. 2. It can be used offshore (integrated in an OBS) or as a stand-alone seismic unit onshore. Both marine and land versions record up to six hydrophones and/or geophones on flash memory of 16 or 32 GByte. It has low power consumption, 3 serial ports, 2 USB ports, LAN interfaces and can operate with wireless, Bluetooth and WIFI interfaces under a Linux operation system. A GPS card is included in the system, recording time and coordinates. Power is provided by batteries or solar panels. Activation of the instrument and selection of the recording parameters can be programmed with any IBM-Linux compatible PC (see also: www.geopro.com).

3. The seismic sensors

All three GPRS connected land stations at Keri, Pirgos and Killini used standard SM6 3-C 4.5 Hz geophones. The satellite station on Strophades Island was equipped with one SM6 geophone and a broadband 3-C seismometer CME 4011. Specifications and performance parameters are given in Figs. 3 and 4. The same broadband sensor was also installed in the OBS of the marine station, offshore Zakynthos Island. The seismic sensors in the OBS are gimbal mounted and therefore the vertical component is always aligned along the plumb line. Orientation of the horizontal components is recorded by an inbuilt compass.

4. The pressure sensor

The marine seismic station was equipped also with a pressure sensor, Esterline type 300DS (Fig. 5) that was attached and connected to the glass sphere of the OBS at the sea bottom. This sensor measures variations of pressure in the water column. Pressure data together with seismic data were transmitted in real time to the base server onshore.



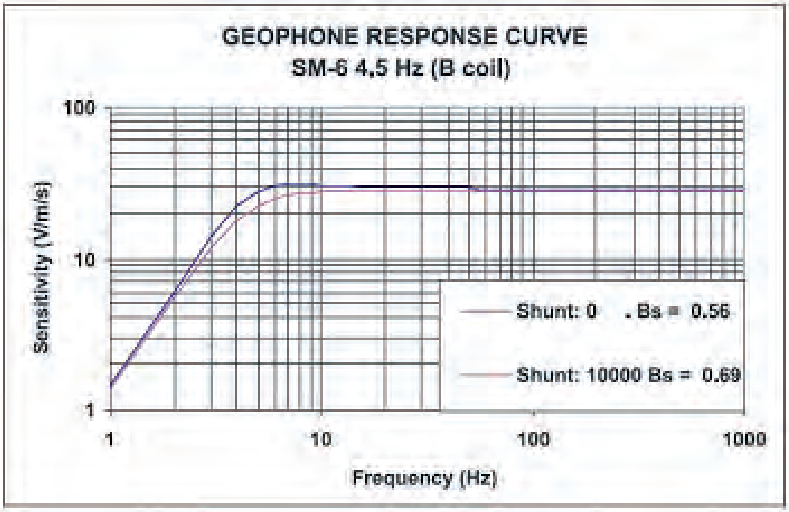
SEDIS V - TECHNICAL SPECIFICATIONS	
Analogue inputs	6 differential channels
Input signal range	+ / - 4.5 V
Over voltage protection	+ / - 40 V
A/D converter	High performance Delta-Sigma CS 5321 on each channel
Digital filters	CS 5322, cut-off frequencies: 500, 250, 125, 62.5 Hz
Dynamic range	120 dB at 250 Hz sample rate
Clock oscillator	Mxa 37/8 1*10-8
Main processor	Intel X Scale PXA 255
Onboard memory	32 Mbytes SDRAM
Data storage interface	PCMCIA
Programming Interface	RS-232
GPS Unit	Trimble embedded GPS receiver SveeSix-CM3
Communication interfaces	LAN, Bluetooth, Serials ports, USB ports
Power supply	voltage; 9 - 36 VDC
Power consumption	1.8 W for 4 channels, 1.2 W for standby
Data storage	16 Gbytes or 32 Gbytes SD Flash Memory Card
Operating system	Linux ®
Size	10.5 x 12.5 x 20 cm3
Weight	1.6 kg

Fig. 2 - The GEOPRO SEDIS V seismic recorder with communication interfaces, power supply and geophone sockets (above) and technical characteristics (below) (see also: www.geopro.com).

5. The "amphibious" seismic and tsunami SEAHELLARC network

5.1. The marine seismic and tsunami station

The real-time offshore seismic station has two parts: 1) the bottom unit, consisting of an OBS sphere with the seismic sensor and the data digitizer in it, and a pressure sensor attached to it, and 2) the surface buoy, containing the energy supply elements, two car batteries and four solar

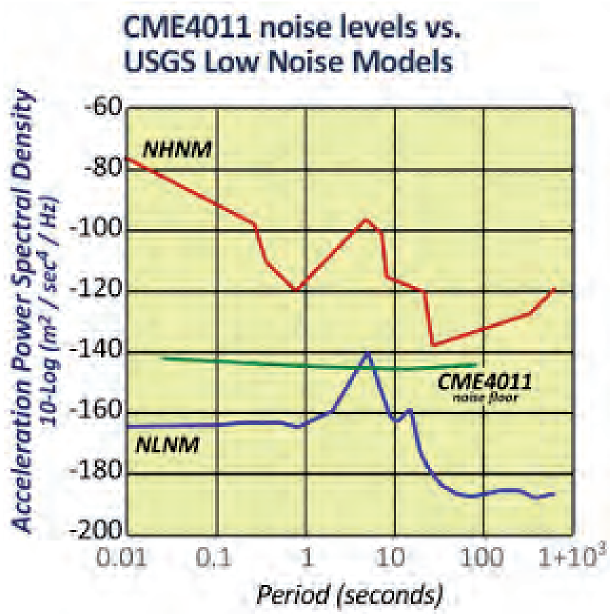


SM-6 LOW FREQUENCY GEOPHONE - TECHNICAL SPECIFICATIONS	
Natural Frequency (fn)	4.5 Hz
Tolerance	± 0.5 Hz
Maximum Tilt Angle for Specified fn	0°
Typical Spurious Frequency	140 Hz
Distortion with 0.7 ips p.p. coil-to-case Velocity	< 0.3%
Distortion Measurement Frequency	12 Hz
Maximum Tilt Angle for Distortion Specification	0°
Open-circuit Damping	0.56
Open-circuit Damping Tolerance	± 5 %
Open-circuit Sensitivity	28.8 V/m/s (0.73 V/in/s)
Sensitivity Tolerance	± 5 %
RtBcfn	6.000 ΩHz
Moving mass	11.1 g (0.39 oz)
Maximum coil excursion p.p.	4 mm (0.16 in)
Diameter	25.4 mm (1 in)
Height	36 mm (1.42 in)
Weight	81 g (2.85 oz)
Operating Temperature Range	-40° C to 100° C

Fig. 3 - The I/O SM6 low frequency geophone: response curve and specifications (see also: www.i-o.com).

panels of 40 W each, and the data logger and processing components, as well as the transmission modems for GPRS, satellite or radio communication. The buoy is anchored at the sea floor by a 500 kg anchor and a rubber expander between the buoy and the anchoring rope that absorbs rapid movements due to heavy weather. The bottom and surface units are electrically connected by a coaxial cable that transfers the A/D converted signals from the sea bottom to the SEDIS processor in the buoy and provides the power needed by the OBS at the sea floor (Fig. 6).

The seismic sensor at the sea bottom is a 3-C broadband CME 4011, 30 s to 50 Hz. A GPS receiver provides continuous timing for the processing unit (SEDIS V CPU). The sensors in the OBS are gimbal mounted. Communication between the bottom and surface units is achieved by



BROADBAND SEISMOMETER CME 4011 - TECHNICAL SPECIFICATIONS	
Transducer type	Molecular Electronic Transfer
Sensitivity	2000 V/m/sec – differential output
Clip level	± 10 mm/s
Standard Bandwidth	30 s – 20 Hz & 60 s – 50 Hz
Dynamic Range	122 dB
Mass lock	Not Required
Mass centering	Not Required
Maximum installation tilt	± 15°
Mechanical Resonances	None
Temperature range	- 12° C to + 55° C
Housing material	Aluminium
Case diameter / height	180 mm / 140 mm
Weight	4.9 kg
Power supply	Standard 12 Vdc noml; 6-16 Vdc

Fig. 4 - The Mettech CME 4011 OBS broadband seismometer: performance curve and specifications (see also: www.SalesMetTechnology.com).

cable that transfers the digitized data to the processor in the buoy, and supplies with power the OBS elements on the sea floor. Processed and formatted data by the SEDIS V are transmitted to a base station by mobile telephony (GPRS connection), where they are recorded and stored for further processing. In Fig. 7 we present the three elements that make up the complete system: the sensors (in green), the surface buoy (in blue), and the base station (in red). We also indicate the three possibilities of transmitting data from offshore to onshore, that is, radio link, GPRS or satellite connection. This OBS-buoy system is the second generation of real-time marine seismic stations. The first generation system of a very similar design using only radio transmission was deployed in the north Evoikos Gulf, central Greece, for several months, in 2006, in the frame of the AMPHITRITE project (www.amphitriti.gr).

Parameter	300DS	Units	Comments
LEVEL RANGES			
Full Scale Level Ranges	700 thru 4614 (210 thru 1408)	ft H2O (m H2O)	sealed gage reference
Proof Pressure	1.5	x FS	
Burst Pressure	2.0	x FS	
STATIC PERFORMANCE			
Static Accuracy	±0.5	% FSO	BFSL method
Resolution	Infinitesimal		
ENVIRONMENTAL			
Wetted Materials	316 SS; Delrin®; Viton®		Delrin® and Viton® are registered trademarks of DuPont.
Compensated Temp Range	0 to 50	°C	
Thermal Error	±0.05	%FSO/°C	worst case over compensated temperature range
Operating Temp Range	-20 to 60 0 to 50	°C °C	when usingpolyurethane cable when using ETFE cable
Protection Rating	IP 68, NEMA 6P		
ELECTRICAL			
Excitation	9 – 30	VDC	for mA and VDC output
Input Current	20 3.5	mA max	for mA output for VDC output
Output	4 – 20 0 – 5	mA VDC	options available
Zero Offset	±0.12 < 0.25	mA VDC	for mA output for VDC output
Output Impedance	See Loop Resistance diagram page 5 of datasheet < 20	ohm	for mA output for VDC output
Insulation Resistance	100	mega ohm	at 50 VDC

Fig. 5 - Pressure sensor Esterline 300DS used for recording tidal and tsunami pressure variations and technical characteristics. This pressure sensor was calibrated to have its maximum scale 0 to 210 m (see also: www.pressuresystems.com/).

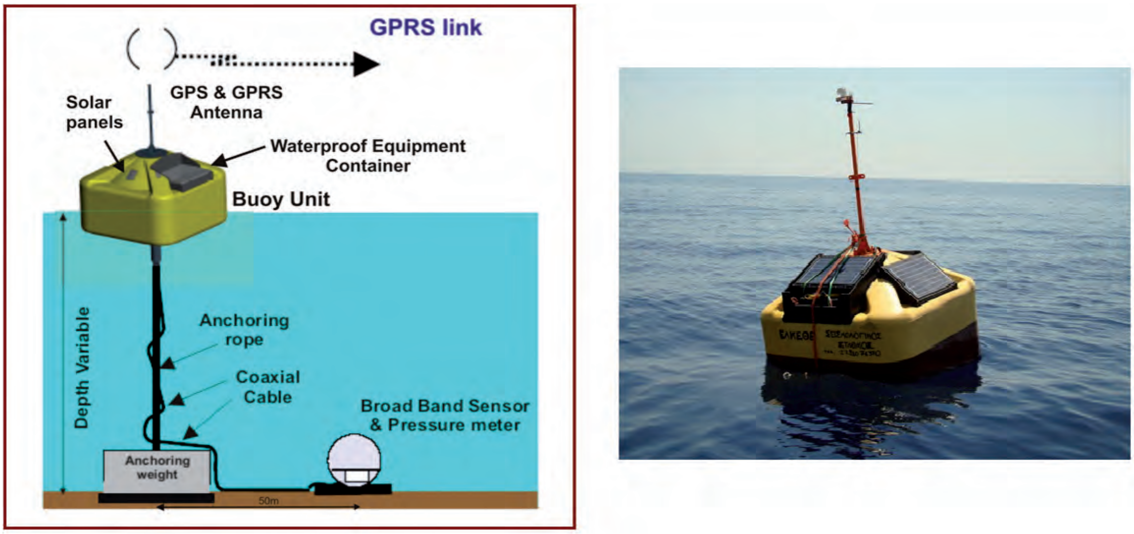


Fig. 6 - Schematic overview of the buoy and its connection to the OBS at the sea floor (left). The buoy (photo from offshore south Zakynthos) is 2.5 x 2.5 x 1 m^3, weights 400 kg, and has a buoyancy of 2.5 tons (right). A navigation light and radar reflector are mounted on it (below).

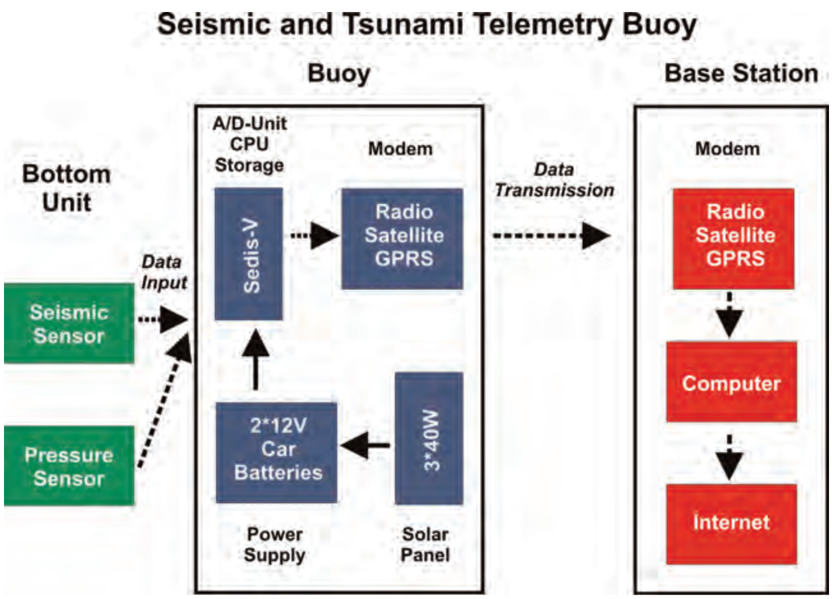


Fig. 7 - Schematic presentation of the three elements composing the complete seismic and tsunami telemetry system.

In Fig. 8 we present an example of a local earthquake recorded by the broadband sensor of the buoy. The upper part of the picture presents the vertical component of the 3-C sensor and the two lower parts are the horizontal components. Noise level for the horizontal components was higher than that of the vertical one. For this reason we used different gain for the different channels. Please note that the difference in amplitude of the two horizontal components is equivalent to 20,000 counts, while for the vertical component is in the scale of 10,000 counts.

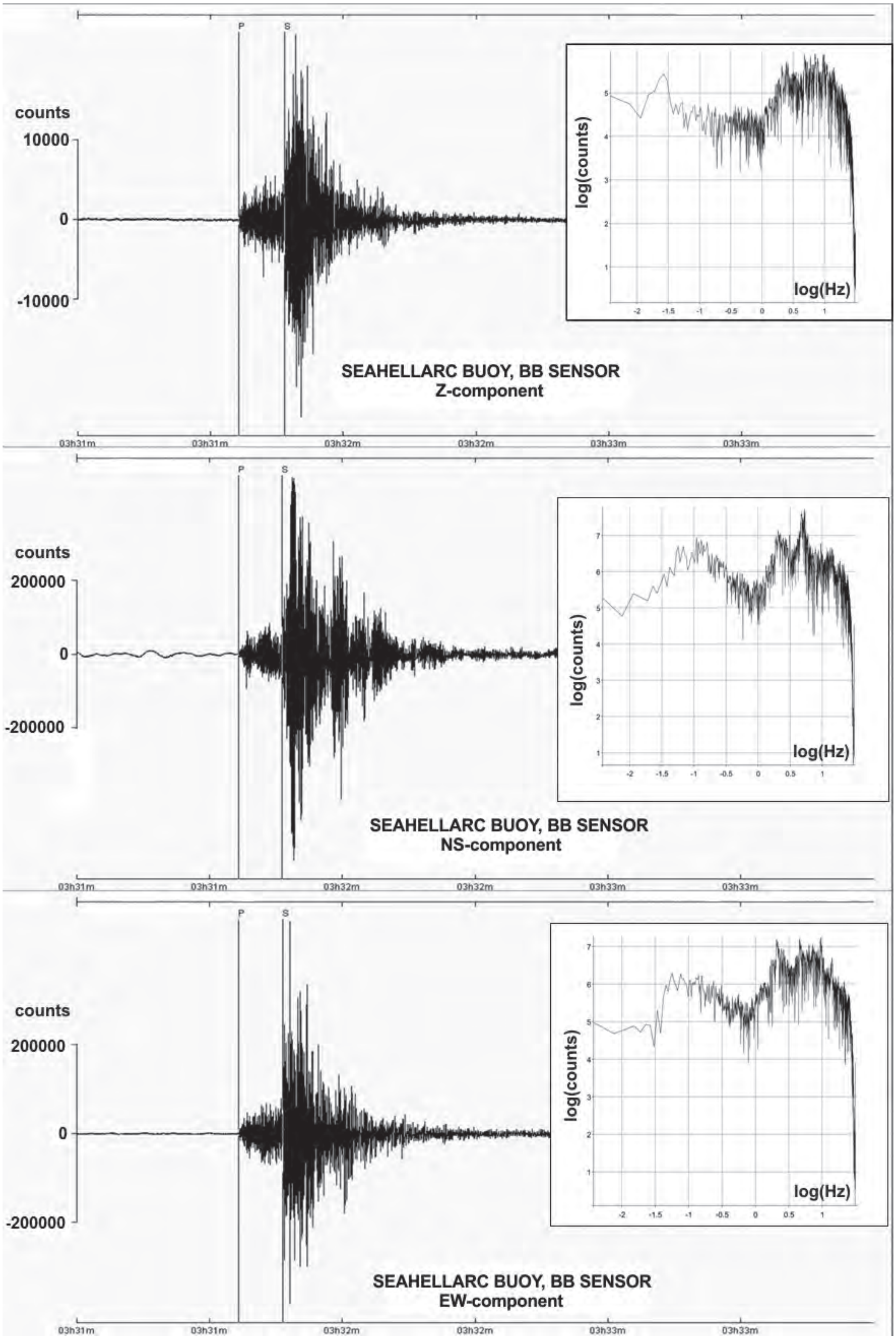


Fig. 8 - Local earthquake record from the broadband sensor of the SEAHELLARC seismic buoy. Spectral plots for each channel are also included.

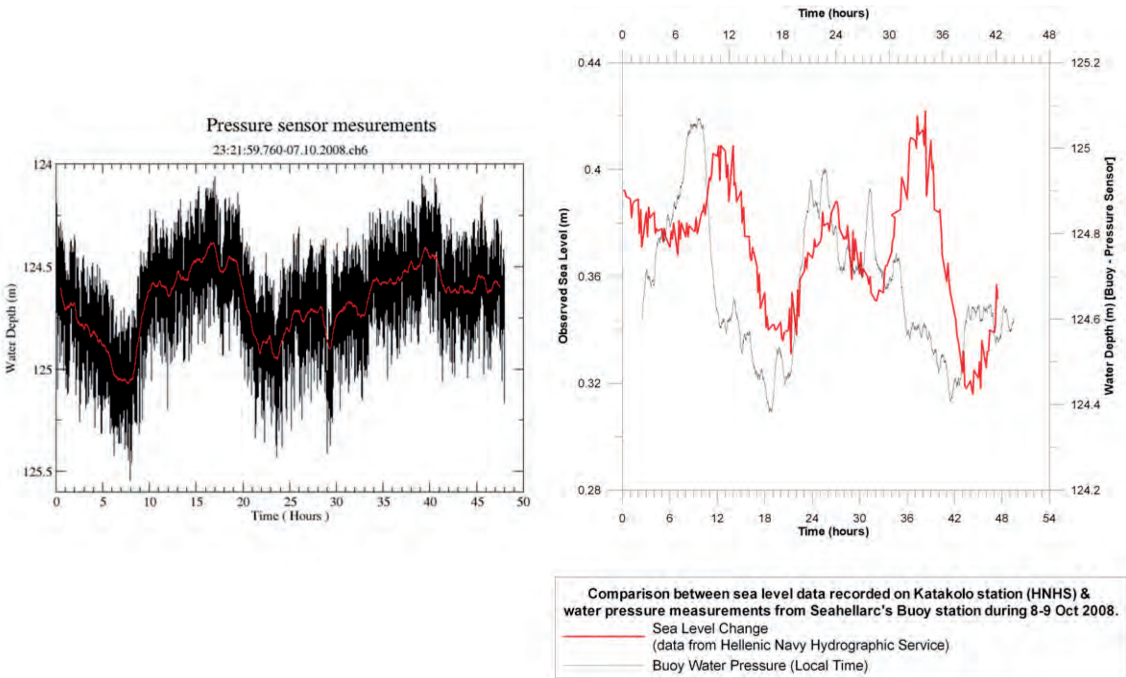


Fig. 9 - Example of a pressure record of the buoy station presenting tidal variations of a period of 48 hours. Red line in the left part of the figure gives the average pressure variation. At the right part of the figure we present a comparison of the tidal effects recorded at the buoy location and the harbour of Katakolo, 45 km further east. Further explanations in text.

This means that the sensitivity of the two horizontal components is two times higher than that of the vertical.

The marine station, that was equipped also with a pressure sensor Esterline 300DS, recorded tidal effects. In Fig. 9 we present an example of a continuous record of 48-hours. The red line gives the average signal of the pressure variations. We have compared the buoy data with the tidal effect recorded in the harbour of Katakolo, which is approximately 45 km to the east of the

Fig. 10 - The seismic station on the Strophades Island (left). Broadband and 4.5 Hz geophone (right).

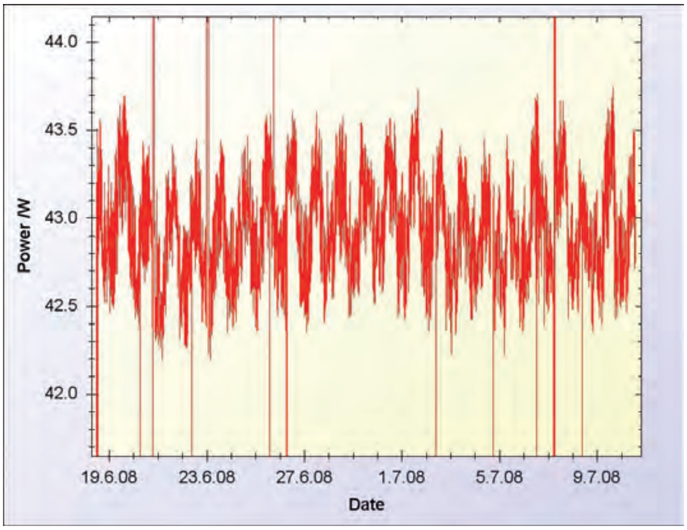


Fig. 11 - Daily power consumption of the satellite station of Strophades.

buoy location. There is a slight shift in time, which is obvious since we are comparing different geographical locations, and the Katakolo station of the Hellenic Navy Hydrographic Service (HNHS) is located further to the east at very shallow water.

5.2. The satellite seismic station on Strophades Island, Ionian Sea

For the seismic station at the Island of Strophades, which is not connected to the mobile telephony network, the link to the base at HCMR, Athens was established by satellite. The provider is HELLASSAT (http://hellas-sat.net/). The IP addresses used for communication were static. The station was equipped with a 3-C broadband seismic sensor Mettech CME Model 4011 30 s to 50 Hz, and a SM6 3C geophone (Fig. 10). Power was provided by 8 solar panels of 80 W each, connected to 8 rechargeable batteries. In Fig. 11 we present the power consumption of the satellite station from 2008/06/19 to 2008/07/09. The high power consumption of 43 W is due to the requirements of the satellite data transmission. During the summer period consumption is compensated by the daily charge, while in winter batteries and solar panels have to be increased by 4 more units. GPRS and radio transmission is feasible at near coast areas. Data transmission speed was 1125 bits/s or approx. 90 Mb per day. We considered the possibility of the satellite connection also for the buoy. An estimation based on data production and power consumption suggests that it could be feasible for one seismic channel and one pressure sensor. This has been achieved by several oceanographic purpose buoys that are in worldwide operation.

Example of a local event recorded at the station Strophades by the SM6 geophone is given in Fig. 12. The three seismic components and their spectral information demonstrate the efficiency of the station. Local noise is quite low depending on the weather conditions. A second example of an earthquake recorded by the broadband sensor is the Tonga Islands M_W 6.9 event of 2008/10/19 (Fig. 13). The time scale is given in hours. Data are low pass filtered with 1 Hz cut-off frequency.

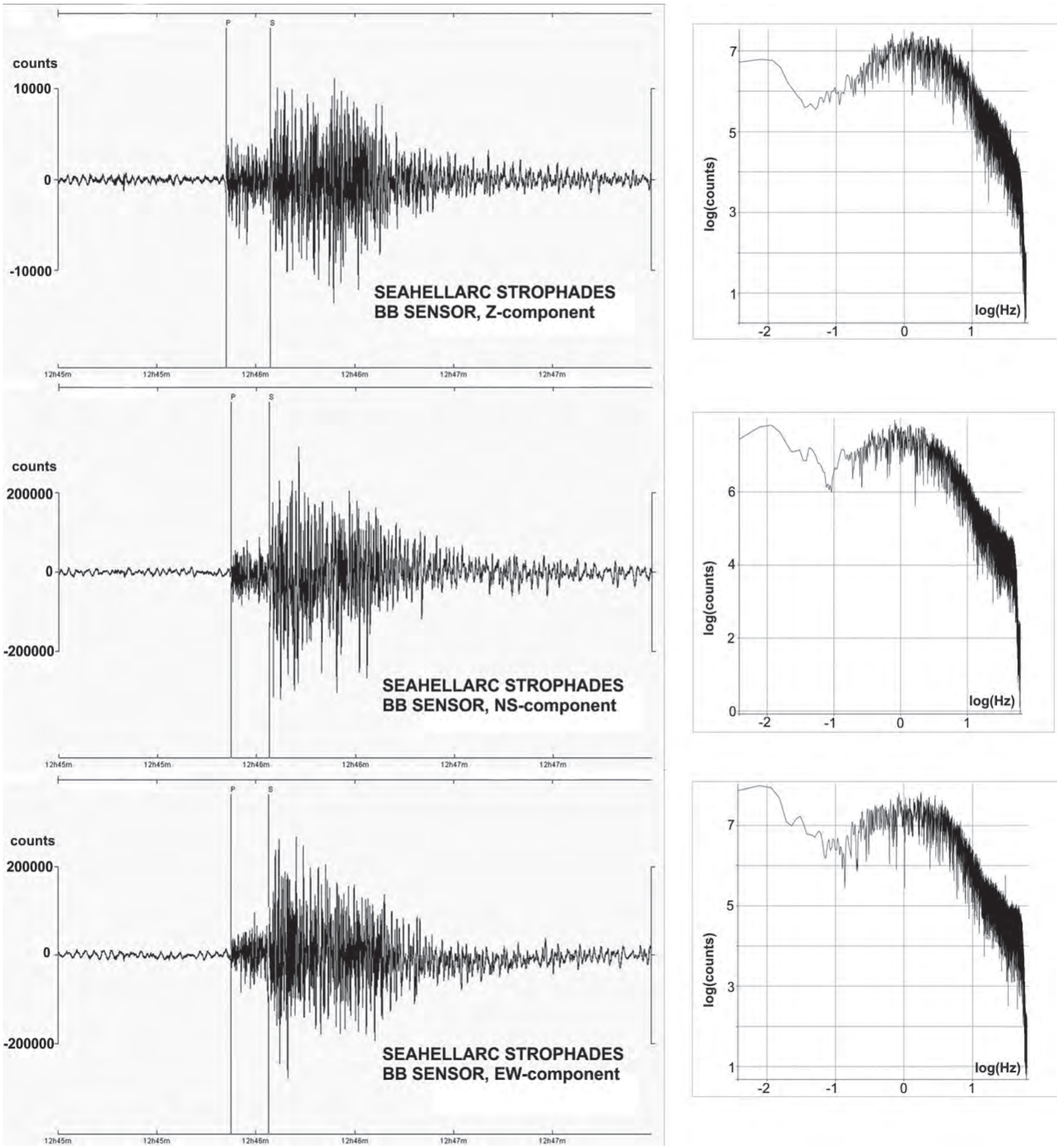


Fig. 12 - Example of a local event recorded at the Strophades station. Respective spectral plots are also presented for each channel.

5.3. The GPRS land stations at Keri, Killini and Pirgos

At the three locations of Keri, Killini and Pirgos the seismic stations were equipped with SM6 geophones. The real-time operation was possible by using GPRS data transmission of the latest generation that could accomplish 1125 bits/s or approximately. 90 Mb per day. Also for these stations the IP addresses used for communication were static. Power was provided by rechargeable batteries and 2 solar panels of 80 W each.

In Fig. 14 we present a local event recorded at the stations Keri, Killini and Pirgos. Data were band-pass filtered and their spectral behaviour is also presented.

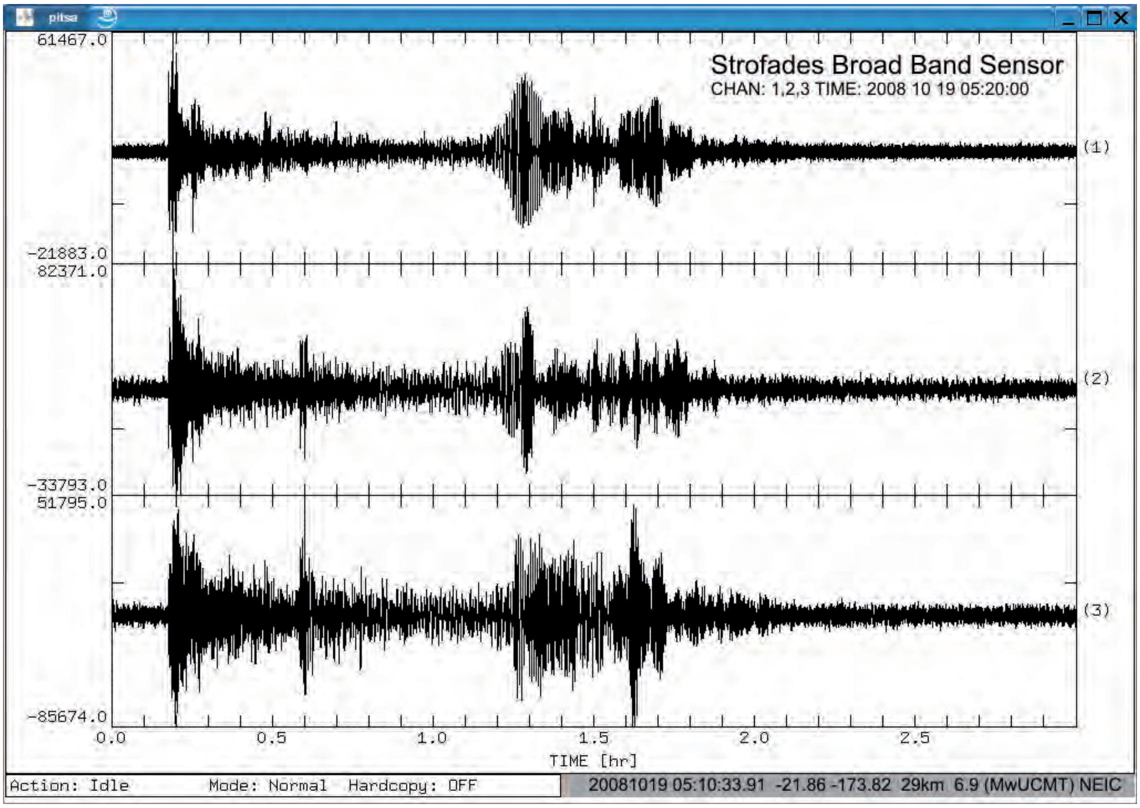


Fig. 13 - Filtered waveforms recorded by the Strophades broadband sensor (components Z - channel 1, E-W - channel 2 and N-S - channel 3) from the 2008/10/19 Tonga Islands event (M_W = 6.9).

5.4. The data base server: data transmission, recording and processing

For the teleseismic real-time data transmission we used Siemens TC35iT GSM modems that permit a dual band low volume data transfer. For the satellite data transfer we used the modem SatNet S4100, which is a dual band device specially designed for low volume data transmission. Data transmission was of very good quality since the links were stable and transmission speed of data satisfied our requirements. The base server had a 24 hours uninterrupted Internet access and special data backup system. Processing, quality control and displaying of incoming data are controlled from special shell scripting software that was developed during SEAHELLARC project and implemented on that server. All end users participating in the project had access using any LINUX supporting computer. Data are miniSEED formatted and can be directly used by any user that has Internet access to the HCMR server.

Recorded data are presented for each station in an hourly screen shot. An example is given in Fig. 15. Data are presented in 5 minute segments and they are colour coded for easier recognition. In the example presented from the station of Pirgos of June 8, 2008 we are showing the M_W 6.4 Andravida earthquake that occurred in north-western Peloponnese at 12:25 (GMT time). For further processing we used the SeisGram2K Seismogram Viewer software by Anthony Lomax (http://alomax.free.fr/) for arrival times picking, and the HYPOINVERSE code (Klein, 2002) for event location. In the following we present as an example of the performance of the near real-time array results obtained for the period 2008/09/25 to 2008/10/21.

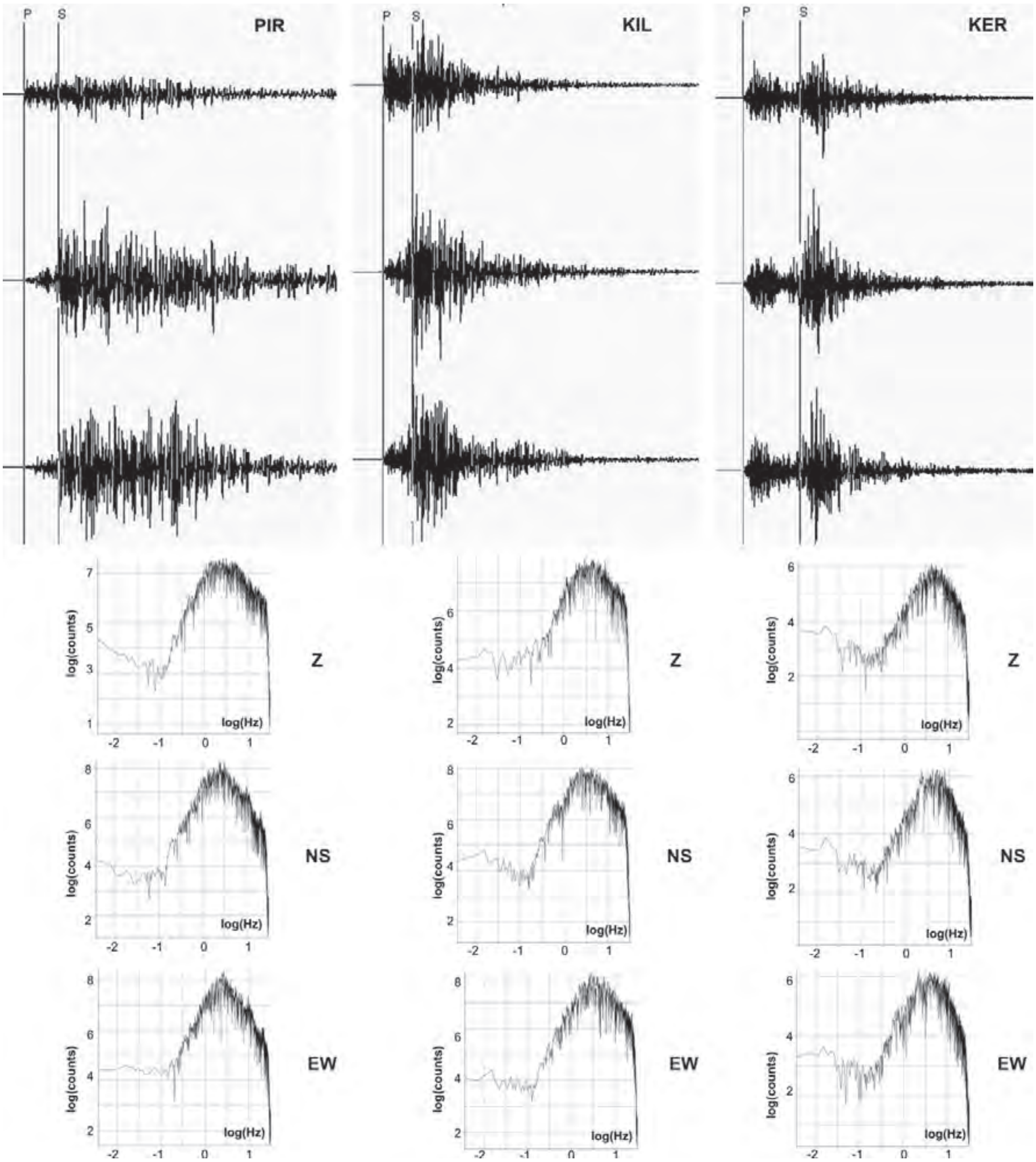


Fig. 14 - Example of recording for a local event on stations Pirgos, Killini and Keri as recorded on the three components of each station (geophone SM6). First row is the vertical component, second row the N-S horizontal component and the third row is the horizontal E-W component. Respective spectral plots are also presented for every channel.

6. Seismicity for the period: September 25, 2008 to October 21, 2008 obtained by the SEAHELLARC seismic array

As an example of the data treated with the procedure described above we present in Fig. 16 a local earthquake recorded at 22:33 local time of September 27, 2008.

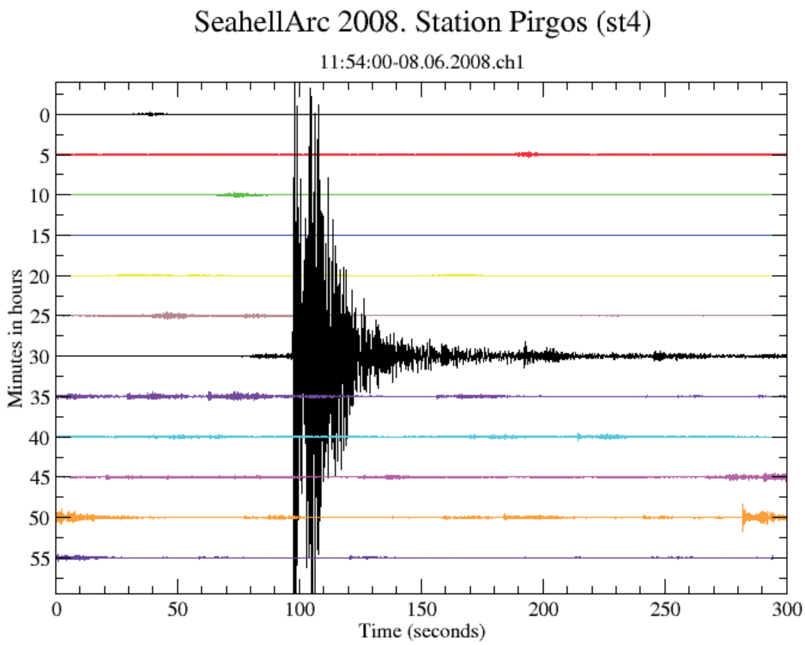


Fig. 15 - Screenshot of hourly recorded data at the station of Pirgos. Time windows of 5 minutes are colour coded for easy recognition of the detected events. The large earthquake is the June 8, 2008 M_W 6.4 Andravida event.

Within a period of almost one month (September 25, 2008 to October 21, 2008) 326 events above a magnitude M_L = 1.0 were analyzed and their hypocentres located. We used a 1D velocity model based on a controlled source seismic experiment (Makris and Papoulia, 2009) as given in Table 1. Magnitudes M_D were defined by the coda-length of the recorded events, (Crosson, 1972) calibrated by earthquakes that were also reported by the National Observatory of Athens. The 326 located events are plotted in the map of Fig. 17 and an earthquake catalogue of the seismic parameters is given in the Appendix. Seismicity distribution per day is presented in the plot of Fig. 18.

Table 1 - Local velocity model for western Greece used in the hypocentral estimation (after Makris and Papoulia, 2009).

P waves Travel Time Velocity (V_P) (km/s)	Depth (km)
4.50	0.00
6.20	4.00
6.80	10.00
8.00	25.00

The seismicity shows intense lineation of NE-SW orientation along the Andravida fault, activated by the main M_W 6.4 Andravida event. Seismicity is also recorded from the SW-NE-oriented dextral strike-slip Cephalonia fault. Seismicity SW of Zakynthos is mainly aligned along thrust faults of NW-SE orientation. For a more detailed discussion of the seismicity and tectonics of this area see SEAHELLARC Working Group (2014).

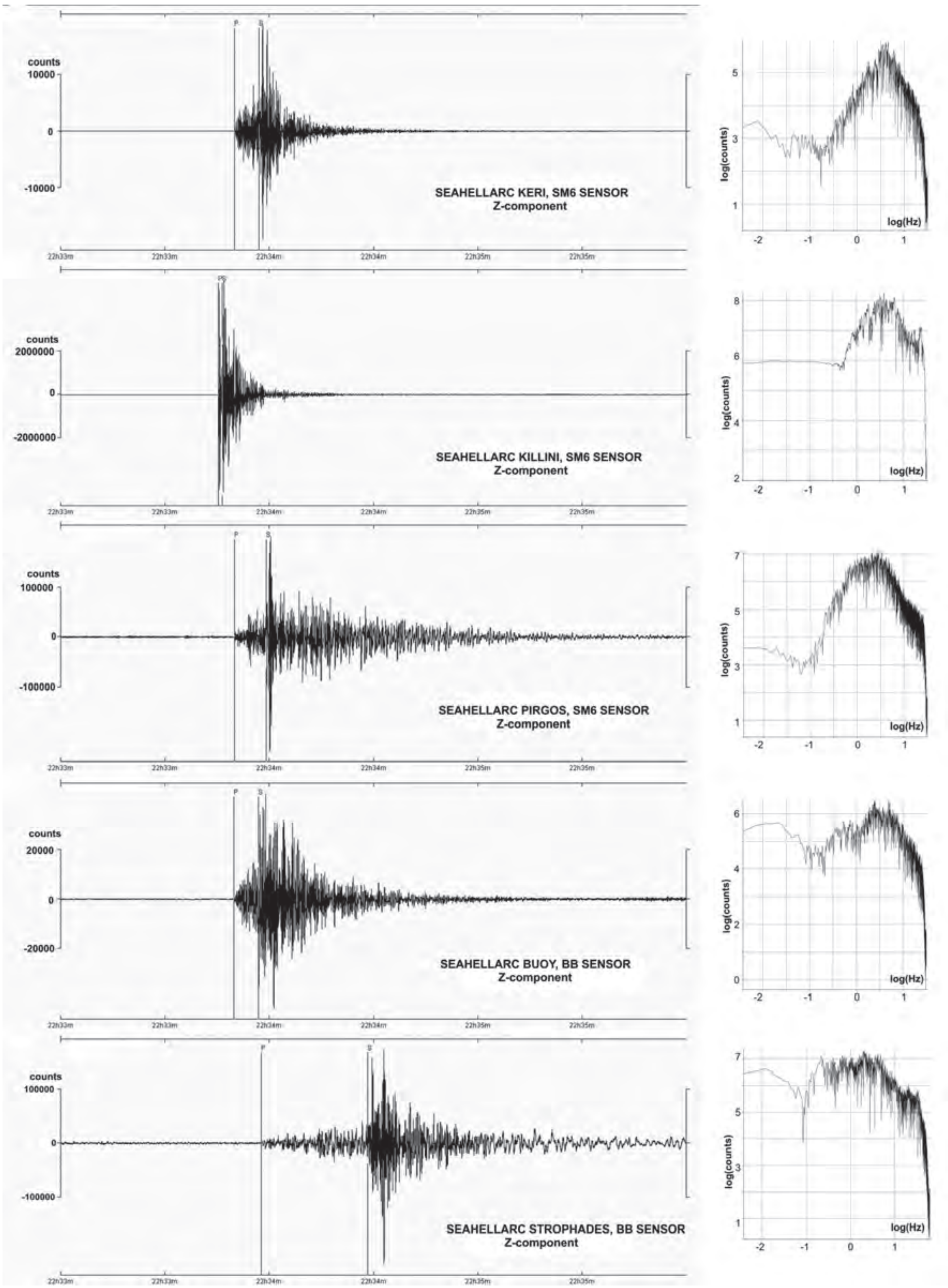


Fig. 16 - Example of real-time picking analysis for an event recorded on September 27, 2008 at 22:33. Five station traces of vertical components and spectral plot are respectively presented. Onsets of P and S waves are also indicated for each trace.

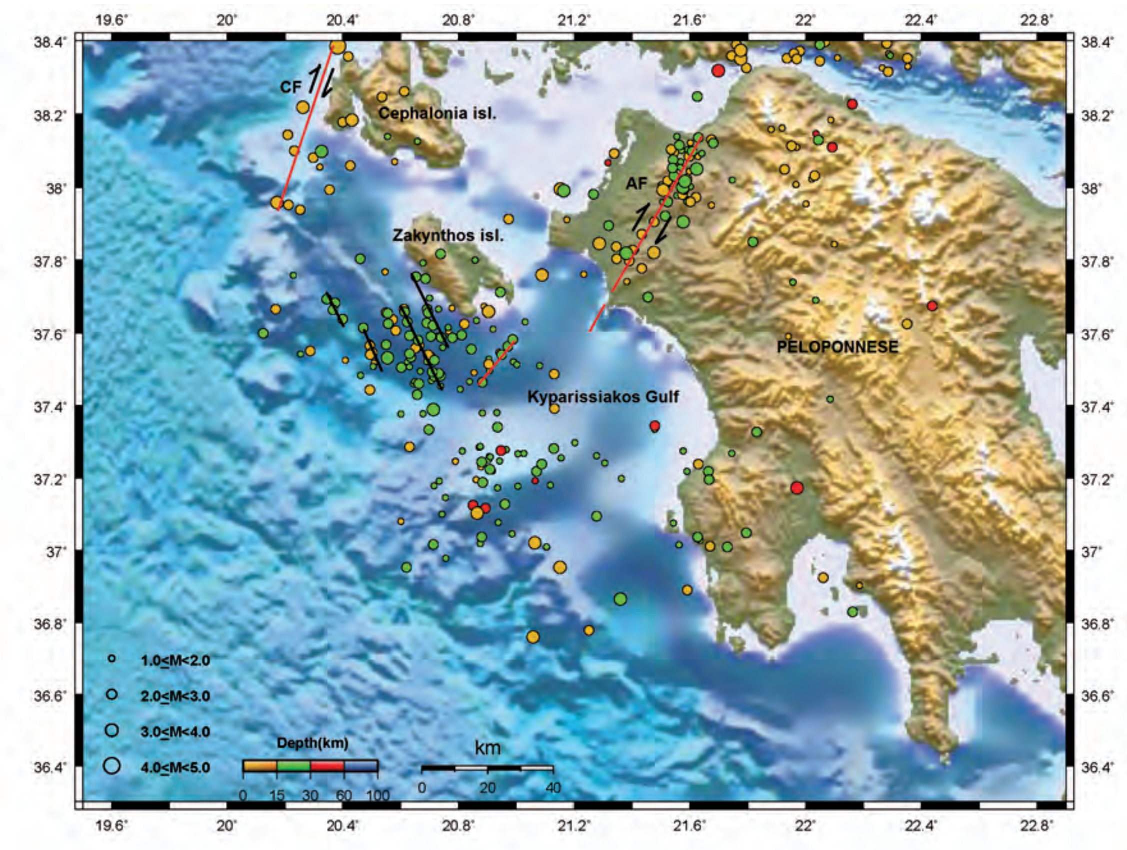


Fig. 17 - Epicentre map of 326 events, recorded in the period September 25, 2008 to October 21, 2008 by the SEAHELLARC "amphibious" real time network. Seismicity cluster located at north-western Peloponnese indicates part of Andravida M_w 6.4, June 8, 2008 aftershock activity. Andravida (AF) and Cephalonia strike slip faults are indicated. Active thrust fault zones SW of Zakynthos are also marked.

7. Conclusions

We have demonstrated that by using GPRS mobile telephony connections it is possible to operate seismological networks efficiently in continuous mode. The system is not only efficient but is also inexpensive since a line connection for data transmission and dual communication capacity costs approximately 30 € per month. In the case of very remote stations we have exploited satellite connections for data transmission and dual communication with the seismic station. However, monthly cost for operating a satellite system is in the order of 400 €. The mobile telephony communication possibility was also exploited for using an offshore station for seismic and tsunami observations in near real time.

We could show that for local seismicity refraction geophones of 4.5 Hz natural frequency are sufficient and provide an inexpensive solution for local and regional requirements. Broadband sensors were used for recording global events.

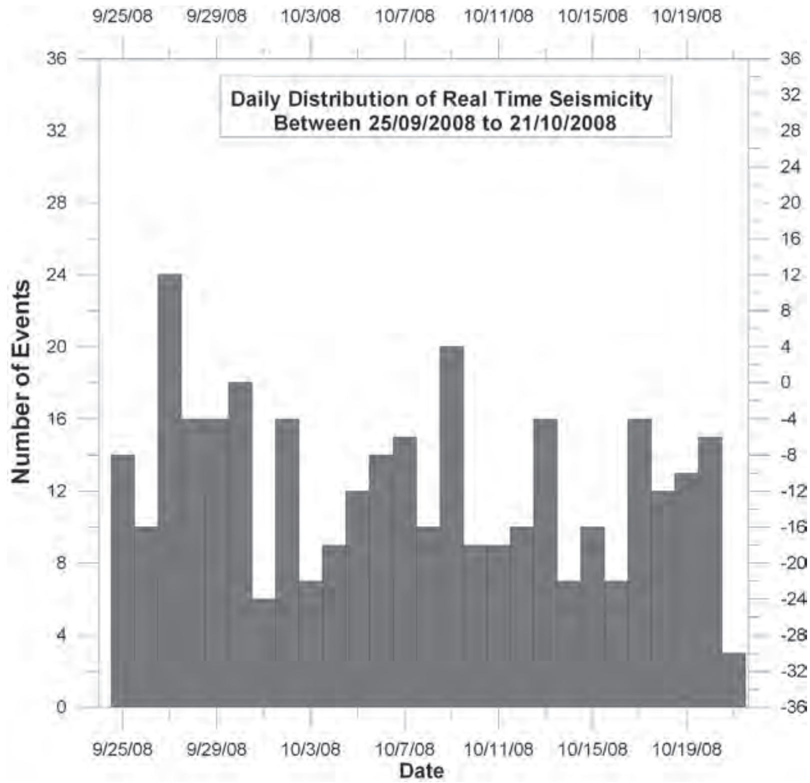


Fig. 18 - Daily distribution of 326 events recorded in the period September 25, 2008 to October 21, 2008 by the SEAHELLARC real-time network.

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Appendix

Catalogue of recorded seismicity (326 events) during the period 2008/09/25 - 2008/10/21

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	SEP	25	00	00	07.00	37.65574	20.54809	6.80	1.7	0.07	0.6	1.1	4
2008	SEP	25	00	14	49.80	37.98006	21.57344	6.20	2.0	0.15	1.0	5.3	4
2008	SEP	25	03	49	18.40	37.17266	21.96890	35.20	3.1	0.26	1.0	1.7	4
2008	SEP	25	08	24	20.50	37.59260	20.62942	22.20	2.5	0.11	1.7	1.8	4
2008	SEP	25	11	28	15.50	37.55104	20.28660	10.40	2.6	0.12	1.4	2.5	4
2008	SEP	25	13	33	30.30	37.56791	20.54893	22.40	1.9	0.12	1.6	2.8	4
2008	SEP	25	14	36	33.10	37.46606	20.64821	16.50	1.7	0.16	1.9	1.0	4
2008	SEP	25	17	45	44.40	37.01647	20.71230	22.60	2.2	0.19	0.9	2.7	4
2008	SEP	25	19	50	50.90	37.61066	20.91863	24.80	1.8	0.10	1.0	1.0	5
2008	SEP	25	20	53	46.90	37.77779	21.43207	12.80	2.0	0.22	1.4	3.7	4
2008	SEP	25	21	54	54.60	37.45407	20.73757	17.90	1.5	0.15	2.8	1.1	4
2008	SEP	25	21	55	54.70	37.48125	20.71526	17.90	1.7	0.14	0.8	9.1	4
2008	SEP	25	21	55	54.80	37.48255	20.73686	17.90	2.9	0.06	1.1	9.0	4
2008	SEP	25	23	03	23.60	37.83699	21.34449	3.00	2.5	0.24	2.8	19.6	4
2008	SEP	26	01	52	36.70	38.10946	22.09136	50.90	2.2	0.18	1.3	14.8	4

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	SEP	26	09	25	20.40	37.00938	21.10372	24.20	1.5	0.18	1.0	1.1	4
2008	SEP	26	13	31	28.40	37.63821	20.39794	27.40	1.4	0.13	2.2	2.0	4
2008	SEP	26	14	34	14.20	37.08015	20.60020	12.50	1.7	0.19	2.4	1.8	4
2008	SEP	26	14	35	14.70	37.46076	20.64266	21.50	1.6	0.16	1.3	1.0	4
2008	SEP	26	14	36	32.40	37.53407	20.63397	21.50	2.7	0.16	0.9	8.9	4
2008	SEP	26	17	16	25.10	37.87152	21.43288	4.50	2.4	0.09	0.8	27.6	4
2008	SEP	26	17	44	13.90	37.24651	20.78848	10.60	1.7	0.05	1.7	1.1	4
2008	SEP	26	21	55	55.30	37.62809	20.68973	21.90	2.9	0.06	0.7	9.5	4
2008	SEP	26	22	15	35.40	37.81867	21.37911	18.20	1.5	0.15	2.6	2.6	4
2008	SEP	27	01	11	13.80	38.42843	22.17090	7.80	1.8	0.27	1.5	2.6	5
2008	SEP	27	01	24	28.50	38.35161	21.93520	5.40	1.7	0.09	0.8	1.9	4
2008	SEP	27	02	06	45.20	38.35252	22.10892	10.50	1.9	0.13	0.9	11.7	4
2008	SEP	27	03	54	59.50	37.38917	20.71209	28.50	3.3	0.07	0.8	9.7	4
2008	SEP	27	04	01	23.50	37.28599	20.62966	8.30	1.4	0.05	0.9	6.2	4
2008	SEP	27	10	25	23.40	37.18053	21.11613	15.30	1.6	0.10	1.1	1.2	4
2008	SEP	27	10	38	01.20	38.07509	21.54171	15.50	2.6	0.58	2.4	28.6	4
2008	SEP	27	11	02	44.50	38.10263	21.59105	22.50	1.9	0.12	1.3	3.6	4
2008	SEP	27	11	28	27.40	37.75431	20.65276	26.30	1.4	0.13	7.7	3.2	4
2008	SEP	27	15	41	38.40	37.17891	20.71492	25.60	1.6	0.18	1.0	1.5	4
2008	SEP	27	15	43	22.80	38.22708	22.16056	37.80	2.7	0.32	1.7	1.2	5
2008	SEP	27	16	04	38.10	38.05533	20.31921	4.50	1.5	0.49	1.6	2.2	4
2008	SEP	27	16	16	18.90	37.97676	21.55378	16.80	1.7	0.11	1.6	2.4	4
2008	SEP	27	17	44	42.80	37.19191	20.73258	28.60	1.7	0.19	1.1	0.7	4
2008	SEP	27	19	47	08.50	37.09406	21.27577	25.90	2.7	0.23	1.2	1.4	5
2008	SEP	27	21	29	39.20	37.82107	21.47462	13.50	1.4	0.10	1.3	2.6	4
2008	SEP	27	22	10	18.70	37.95124	20.21160	7.00	2.2	0.12	0.9	12.3	5
2008	SEP	27	22	23	58.90	38.36395	22.28595	14.50	1.9	0.47	1.7	3.6	5
2008	SEP	27	22	33	43.50	37.75903	21.08797	6.70	3.1	0.09	0.7	1.0	5
2008	SEP	27	22	56	56.40	37.18774	20.88267	21.90	1.5	0.10	1.2	0.8	4
2008	SEP	27	23	06	56.40	37.99051	21.16331	22.00	3.3	0.15	0.6	1.5	4
2008	SEP	27	23	09	15.60	37.93845	20.25105	9.40	2.3	0.56	9.5	26.3	4
2008	SEP	27	23	15	25.50	37.63086	21.02983	18.00	1.9	0.09	1.1	0.9	5
2008	SEP	27	23	48	55.80	37.99473	21.15071	6.10	1.4	0.39	0.9	1.0	5
2008	SEP	28	01	02	02.70	37.60666	20.58181	8.50	2.2	0.13	1.1	1.3	4
2008	SEP	28	02	08	05.90	37.55538	20.84371	20.00	1.7	0.08	0.8	0.7	5
2008	SEP	28	02	09	06.50	37.12470	20.84895	33.00	2.1	0.10	1.3	1.4	4
2008	SEP	28	02	48	04.30	37.96583	21.59659	12.30	1.8	0.24	1.4	3.0	5
2008	SEP	28	02	52	57.20	37.98884	21.57943	16.10	1.6	0.10	1.1	2.5	4
2008	SEP	28	03	01	03.00	37.56482	20.66302	8.00	1.5	0.12	1.1	1.2	4
2008	SEP	28	03	31	38.40	37.99166	21.50673	7.90	3.0	0.19	1.0	1.4	4

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	SEP	28	07	23	18.30	37.26789	21.02456	25.20	1.5	0.09	1.1	1.2	4
2008	SEP	28	08	35	13.80	37.95979	21.52254	15.60	2.2	0.17	2.2	13.7	4
2008	SEP	28	10	26	24.60	37.56571	20.48929	24.30	1.6	0.05	2.3	0.9	4
2008	SEP	28	12	30	27.20	37.52060	20.62292	24.40	1.6	0.12	0.6	0.9	4
2008	SEP	28	13	54	14.60	38.14601	22.03482	45.80	1.8	0.22	1.4	3.2	4
2008	SEP	28	14	33	18.10	37.03728	21.62537	19.30	1.6	0.20	0.9	1.6	5
2008	SEP	28	19	49	49.70	37.66550	20.69116	22.80	2.2	0.12	0.7	1.2	4
2008	SEP	28	21	53	52.20	37.07762	20.93588	20.80	1.9	0.10	1.6	0.7	5
2008	SEP	28	22	58	58.70	37.51307	21.00074	25.90	1.9	0.09	0.8	1.0	5
2008	SEP	29	00	01	07.00	37.54604	20.50113	7.20	2.2	0.14	0.7	1.3	4
2008	SEP	29	02	05	25.60	38.41232	20.34397	6.20	1.6	0.30	1.1	1.1	5
2008	SEP	29	02	50	22.10	37.00962	21.72854	18.60	2.1	0.10	1.0	0.6	5
2008	SEP	29	03	05	38.60	38.38477	20.38197	12.00	4.1	0.33	1.8	1.5	4
2008	SEP	29	03	45	48.60	38.35633	20.41722	11.80	2.1	0.10	3.7	3.4	5
2008	SEP	29	06	18	26.00	37.34432	21.47787	32.10	2.0	0.18	4.9	4.8	4
2008	SEP	29	09	38	51.20	38.40115	22.01005	5.80	3.0	0.21	1.3	19.2	4
2008	SEP	29	11	28	27.40	37.59953	20.12382	24.40	2.6	0.04	1.0	4.0	4
2008	SEP	29	12	37	53.90	38.35038	21.77516	12.60	3.9	0.20	1.5	14.9	4
2008	SEP	29	13	07	10.60	38.40553	21.73265	8.60	1.4	0.10	1.0	1.5	5
2008	SEP	29	13	11	22.20	38.38958	21.75974	12.50	2.0	0.14	0.8	21.2	4
2008	SEP	29	19	08	29.50	37.95824	20.17152	8.60	1.4	0.13	0.6	1.1	5
2008	SEP	29	19	25	35.50	38.37179	21.97870	5.50	2.5	0.18	1.6	1.6	5
2008	SEP	29	20	35	31.50	38.11514	21.56285	20.40	2.6	0.33	1.7	1.4	4
2008	SEP	29	21	01	08.10	38.41385	21.95454	11.70	2.8	0.28	1.2	2.7	4
2008	SEP	29	22	58	32.10	37.54704	20.93881	12.90	1.9	0.10	0.6	1.1	5
2008	SEP	30	00	01	04.00	37.56496	20.49293	7.60	2.1	0.14	0.8	1.1	4
2008	SEP	30	01	02	02.30	37.66565	20.61089	9.50	2.3	0.13	0.9	1.3	4
2008	SEP	30	02	24	45.50	38.42344	21.76056	4.80	2.1	0.14	0.7	1.5	4
2008	SEP	30	02	56	45.80	38.38862	22.04769	26.50	2.1	0.33	3.7	2.7	4
2008	SEP	30	02	56	52.20	38.39629	22.06442	10.50	2.5	0.11	0.9	12.0	4
2008	SEP	30	04	16	46.00	37.51028	21.07945	27.10	1.5	0.09	1.8	10.7	4
2008	SEP	30	05	24	03.20	37.69007	22.03419	15.20	1.7	0.12	0.9	2.6	4
2008	SEP	30	06	19	19.00	37.33486	21.47816	19.10	1.5	0.11	1.6	2.0	5
2008	SEP	30	10	26	24.80	37.48361	20.46066	29.30	1.6	0.12	0.8	1.0	4
2008	SEP	30	12	30	27.40	37.76799	20.54486	13.40	1.6	0.05	1.1	1.9	4
2008	SEP	30	17	37	27.30	38.08325	21.59635	23.20	1.8	0.37	2.1	3.1	5
2008	SEP	30	18	48	47.70	37.03697	20.87888	27.70	2.1	0.20	1.3	1.1	4
2008	SEP	30	20	52	11.80	37.22386	20.90799	20.80	1.5	0.09	1.5	2.8	5
2008	SEP	30	21	53	11.60	37.49687	20.90614	21.80	1.6	0.09	1.0	0.6	4
2008	SEP	30	21	53	53.10	37.52797	20.90391	26.80	1.8	0.09	0.9	2.3	4

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	SEP	30	21	54	53.40	37.11269	20.86972	16.80	1.9	0.19	1.2	1.8	4
2008	SEP	30	21	54	54.20	37.69630	20.69945	17.80	1.8	0.07	1.4	1.1	4
2008	SEP	30	23	58	10.20	37.27900	20.96433	27.90	1.9	0.09	0.7	0.8	5
2008	OCT	01	00	00	07.00	37.39216	21.13037	7.60	2.1	0.10	0.9	1.6	5
2008	OCT	01	00	00	09.00	37.51479	20.90312	5.80	1.5	0.10	0.9	1.3	5
2008	OCT	01	02	55	28.90	37.01099	21.66891	7.50	1.6	0.24	1.1	1.9	4
2008	OCT	01	09	08	32.30	38.12883	22.04330	25.40	2.8	0.24	1.4	2.8	4
2008	OCT	01	09	09	34.40	38.11295	21.95024	10.50	1.6	0.17	1.2	1.1	4
2008	OCT	01	23	19	08.20	38.00640	21.50023	23.60	1.8	0.23	1.3	2.7	5
2008	OCT	02	01	03	02.40	37.54010	20.69475	9.10	2.0	0.12	1.6	1.1	5
2008	OCT	02	01	03	03.30	36.95313	20.61868	19.00	1.6	0.25	1.2	1.5	5
2008	OCT	02	01	04	03.60	37.21826	21.06880	26.00	1.5	0.10	1.4	1.1	5
2008	OCT	02	01	05	02.10	37.49259	20.70823	19.00	2.0	0.14	0.7	1.1	5
2008	OCT	02	01	05	03.70	37.42980	20.65571	17.00	2.4	0.14	0.7	1.4	4
2008	OCT	02	01	05	04.70	37.58761	20.73918	22.00	1.7	0.14	0.9	1.7	4
2008	OCT	02	01	06	01.30	37.62099	20.71058	22.00	2.0	0.16	0.9	1.4	4
2008	OCT	02	01	07	04.90	37.27505	20.81255	29.00	1.4	0.08	1.3	1.7	4
2008	OCT	02	01	07	05.20	37.44500	20.80462	21.00	1.4	0.08	0.9	1.1	4
2008	OCT	02	12	23	25.80	38.04338	21.59720	13.50	1.5	0.26	1.3	2.1	4
2008	OCT	02	16	34	35.20	38.09958	20.23155	7.80	2.2	0.19	1.4	13.3	4
2008	OCT	02	17	22	24.70	37.73931	21.95485	18.20	1.5	0.27	1.4	2.0	5
2008	OCT	02	17	26	39.50	38.13818	21.55454	19.80	1.5	0.09	1.1	2.2	4
2008	OCT	02	19	08	55.10	38.02242	21.58902	14.50	2.1	0.49	6.9	6.7	4
2008	OCT	02	19	48	48.70	37.28725	20.87449	22.70	1.8	0.08	0.9	8.8	4
2008	OCT	02	22	57	45.90	38.03117	21.54306	17.30	1.5	0.26	1.4	1.2	5
2008	OCT	03	02	08	05.90	37.14581	20.75386	18.00	1.4	0.10	1.3	0.8	4
2008	OCT	03	02	09	06.50	37.11674	20.89238	38.00	1.8	0.22	1.6	1.4	4
2008	OCT	03	02	10	01.70	37.79998	20.85658	20.00	1.4	0.08	1.2	0.8	4
2008	OCT	03	03	11	00.50	37.46389	20.88115	24.00	1.5	0.08	1.0	0.9	5
2008	OCT	03	12	45	33.20	37.84531	21.28622	5.20	3.7	0.13	1.2	1.9	4
2008	OCT	03	13	42	28.50	37.80353	21.34520	3.90	2.9	0.37	1.0	1.2	5
2008	OCT	03	19	49	49.50	37.28575	20.87121	22.80	1.6	0.08	0.9	2.1	4
2008	OCT	04	03	11	03.90	37.28186	21.12841	18.00	2.0	0.09	1.5	1.2	5
2008	OCT	04	03	11	08.80	37.38005	20.88126	15.00	1.4	0.08	1.0	2.2	4
2008	OCT	04	03	11	09.20	37.12789	20.95910	17.00	2.1	0.20	0.9	1.2	4
2008	OCT	04	03	11	09.90	37.33366	20.69668	24.10	2.4	0.06	0.7	1.6	5
2008	OCT	04	12	22	48.40	37.65945	20.90304	2.80	3.0	0.08	0.8	0.6	5
2008	OCT	04	13	06	46.80	38.16231	21.91778	3.60	1.0	0.27	1.4	1.9	5
2008	OCT	04	16	53	16.20	38.10886	21.96817	9.40	1.6	0.17	2.8	2.4	4
2008	OCT	04	18	45	20.30	38.32549	21.79470	11.20	2.1	0.14	1.0	3.4	4

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	OCT	04	23	21	52.20	36.82967	22.16129	18.10	2.9	0.22	1.6	1.4	4
2008	OCT	05	04	12	09.30	37.50551	20.60142	25.10	1.5	0.04	0.9	1.5	4
2008	OCT	05	04	12	09.60	37.59080	20.70427	22.10	1.5	0.11	1.1	1.6	4
2008	OCT	05	13	46	38.10	38.35151	22.35112	6.80	2.9	0.32	1.0	1.4	4
2008	OCT	05	16	12	46.70	38.39267	22.27946	10.60	2.1	0.11	2.0	3.8	4
2008	OCT	05	19	49	50.70	37.23083	20.87642	13.80	1.8	0.08	1.0	0.8	4
2008	OCT	05	20	32	28.10	38.09591	21.54404	7.20	2.1	0.32	1.7	7.2	5
2008	OCT	05	21	02	27.20	38.00151	21.56918	4.00	1.8	0.31	1.3	2.9	5
2008	OCT	05	21	25	12.80	38.01736	21.52268	3.40	2.3	0.17	1.0	26.0	5
2008	OCT	05	21	28	56.20	38.01484	21.57907	8.80	1.5	0.23	1.7	2.1	4
2008	OCT	05	21	54	54.70	37.27585	20.94534	33.90	2.0	0.10	0.9	1.4	5
2008	OCT	05	22	56	56.20	37.24726	20.94161	29.90	1.9	0.09	0.5	1.5	5
2008	OCT	05	22	57	57.60	37.38101	20.93151	29.90	1.9	0.09	0.8	0.7	5
2008	OCT	06	04	12	00.70	37.56349	20.96982	15.10	2.4	0.09	1.0	1.3	5
2008	OCT	06	04	12	09.80	37.34040	20.93338	24.10	2.4	0.09	0.8	1.3	5
2008	OCT	06	04	13	59.00	37.26730	21.00490	22.10	1.4	0.09	1.0	2.4	4
2008	OCT	06	04	14	51.00	37.71216	20.94334	27.10	2.4	0.09	0.8	0.6	5
2008	OCT	06	04	14	53.00	37.54062	20.94804	22.10	2.4	0.09	0.7	0.6	5
2008	OCT	06	04	15	47.00	37.04608	20.98375	27.10	1.4	0.10	1.6	1.6	4
2008	OCT	06	05	17	38.00	37.74949	20.68422	16.10	2.5	0.13	0.9	1.7	4
2008	OCT	06	05	17	43.00	37.25593	21.15373	21.10	1.5	0.09	0.8	0.7	4
2008	OCT	06	18	15	13.10	37.97274	21.62036	14.60	2.3	0.36	2.1	1.1	4
2008	OCT	06	19	12	36.50	37.99974	21.57415	22.30	1.7	0.39	1.5	1.2	5
2008	OCT	06	19	50	50.60	37.46623	20.83785	27.80	1.8	0.08	0.7	1.1	4
2008	OCT	06	20	30	12.10	38.36476	21.95860	9.50	2.8	0.12	1.1	3.5	4
2008	OCT	06	20	51	51.60	37.67348	20.88711	14.80	1.8	0.08	0.8	1.8	5
2008	OCT	06	22	56	56.70	37.25986	20.90537	14.90	1.9	0.10	1.5	1.0	5
2008	OCT	07	03	23	05.50	37.90556	21.47534	3.90	1.5	0.11	3.7	8.4	4
2008	OCT	07	04	21	26.50	36.90168	22.18531	5.10	1.7	0.21	0.9	1.9	5
2008	OCT	07	04	47	41.10	38.12478	20.65667	15.60	1.5	0.17	1.1	2.2	4
2008	OCT	07	06	17	58.00	37.54231	20.25321	25.10	1.5	0.07	2.0	0.8	4
2008	OCT	07	06	18	14.00	37.50775	20.50420	20.10	1.5	0.14	0.7	0.9	4
2008	OCT	07	06	18	27.00	37.54027	20.49377	12.10	1.5	0.07	0.9	1.7	4
2008	OCT	07	06	18	30.00	37.80444	20.45961	20.10	2.5	0.21	1.7	18.9	4
2008	OCT	07	07	35	38.50	38.35814	21.74259	11.80	2.2	0.12	1.2	11.1	4
2008	OCT	07	10	05	32.10	38.09764	21.60719	23.20	1.5	0.29	3.1	3.9	4
2008	OCT	07	11	15	42.10	38.15845	21.87954	3.90	1.2	0.18	0.8	1.9	4
2008	OCT	07	12	31	48.30	38.34459	22.04876	8.40	2.0	0.29	3.6	3.4	5
2008	OCT	07	16	21	32.40	37.10261	20.86363	5.10	3.8	0.27	1.4	1.1	5
2008	OCT	07	19	19	52.60	38.14302	20.20907	6.50	1.7	0.10	0.9	2.0	4

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	OCT	07	22	44	58.40	37.90489	21.57560	20.30	1.7	0.36	1.5	1.7	5
2008	OCT	07	22	57	58.70	37.52041	20.98871	23.90	1.9	0.09	1.1	1.5	5
2008	OCT	08	01	37	44.50	37.52563	20.40800	4.60	1.5	0.16	1.5	0.9	4
2008	OCT	08	02	52	24.50	38.00203	21.60128	17.50	1.2	0.21	1.4	1.9	4
2008	OCT	08	06	20	19.00	37.23855	21.08671	17.10	2.0	0.10	1.4	1.1	5
2008	OCT	08	06	21	16.30	37.51799	20.50699	10.10	1.5	0.12	2.0	2.8	4
2008	OCT	08	06	21	16.90	37.17770	21.00400	17.10	1.5	0.10	1.5	1.0	5
2008	OCT	08	06	32	33.20	37.89527	21.31831	18.00	2.3	0.21	2.2	17.2	4
2008	OCT	08	06	51	32.90	37.84330	22.09881	10.20	1.4	0.21	1.4	1.9	4
2008	OCT	08	13	36	23.50	37.66582	20.16645	14.30	2.3	0.14	1.0	1.4	4
2008	OCT	08	14	44	10.20	38.01962	21.74463	15.80	1.6	0.16	1.5	2.6	4
2008	OCT	08	18	15	20.60	38.10380	21.53461	9.10	2.0	0.11	2.6	4.4	4
2008	OCT	09	01	48	52.40	37.99389	21.52676	27.80	1.3	0.26	1.0	1.9	5
2008	OCT	09	01	58	01.20	38.10049	21.56983	15.70	1.5	0.41	3.5	2.1	5
2008	OCT	09	02	14	52.10	38.06975	20.57872	11.50	1.5	0.10	1.8	2.0	4
2008	OCT	09	05	10	48.50	37.82913	21.41110	5.10	1.6	0.15	0.9	2.4	4
2008	OCT	09	05	54	51.60	37.76096	21.23257	2.90	1.9	0.09	2.0	0.9	5
2008	OCT	09	07	21	16.90	37.19316	21.06358	35.10	1.5	0.10	0.9	0.8	5
2008	OCT	09	07	21	18.50	37.62578	20.55552	27.20	1.6	0.05	0.9	1.9	4
2008	OCT	09	07	23	18.70	37.52182	20.68950	17.20	1.5	0.12	0.6	1.9	4
2008	OCT	09	07	23	19.80	37.53861	20.70553	25.20	1.5	0.04	0.7	0.8	5
2008	OCT	09	07	23	19.80	37.66848	20.77618	14.20	1.5	0.06	0.6	0.8	5
2008	OCT	09	07	24	16.80	37.56019	20.74466	20.20	1.5	0.13	1.2	0.9	4
2008	OCT	09	08	24	15.70	37.60510	20.76407	14.20	1.5	0.12	1.0	0.8	4
2008	OCT	09	08	24	19.50	37.63742	20.57145	13.20	2.5	0.05	1.0	1.9	4
2008	OCT	09	10	19	31.10	37.69855	21.45459	19.60	2.2	0.17	0.9	14.9	5
2008	OCT	09	14	47	21.00	37.48696	21.12910	10.50	2.4	0.09	0.8	1.5	5
2008	OCT	09	16	29	14.20	37.82795	21.40184	11.20	2.0	0.36	1.6	4.7	4
2008	OCT	09	16	36	24.40	38.13819	20.55399	17.20	1.5	0.20	1.3	2.1	4
2008	OCT	09	17	29	34.10	37.99327	20.35322	7.80	2.7	0.34	1.6	1.2	5
2008	OCT	09	17	44	14.20	38.08088	20.29671	9.30	2.3	0.23	1.8	27.0	4
2008	OCT	09	22	30	09.20	37.91102	21.17342	4.90	1.8	0.22	1.1	2.6	4
2008	OCT	10	08	48	55.10	36.92442	22.05966	2.70	2.4	0.27	1.4	1.5	4
2008	OCT	10	09	25	21.80	37.50727	20.62930	24.20	1.5	0.07	1.3	2.8	5
2008	OCT	10	09	25	21.90	37.17308	20.93395	19.20	1.5	0.18	1.6	1.6	4
2008	OCT	10	09	25	23.70	37.25892	20.90833	26.20	1.5	0.09	1.0	1.6	4
2008	OCT	10	09	25	23.90	37.21918	20.91659	43.20	1.6	0.09	1.4	9.4	4
2008	OCT	10	11	45	29.30	37.95029	21.67310	13.30	1.6	0.21	1.1	2.2	4
2008	OCT	10	19	09	42.10	38.18392	20.43110	2.50	3.6	0.10	1.0	1.5	5
2008	OCT	10	19	54	42.90	37.92165	21.51390	19.60	2.9	0.25	3.7	3.2	4

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	OCT	10	22	10	20.70	38.00459	21.59468	5.80	1.6	0.20	1.5	2.2	5
2008	OCT	11	01	15	33.40	38.26204	20.61160	9.20	2.0	0.11	1.0	1.6	4
2008	OCT	11	01	16	35.90	38.05885	20.42458	3.70	2.0	0.19	1.1	3.9	5
2008	OCT	11	03	10	22.20	38.09773	20.32587	16.00	1.4	0.59	5.5	37.1	4
2008	OCT	11	05	20	44.90	38.01570	21.58206	24.00	3.0	0.19	1.0	1.7	5
2008	OCT	11	09	25	23.80	37.61418	20.46984	26.20	1.6	0.07	1.2	2.0	4
2008	OCT	11	19	33	03.50	36.95254	21.15012	11.00	1.5	0.21	0.9	1.5	4
2008	OCT	11	19	49	50.20	37.63433	20.86125	29.80	1.8	0.08	2.0	1.3	5
2008	OCT	11	20	51	51.20	37.25087	20.90246	25.80	1.8	0.08	1.1	1.0	4
2008	OCT	11	21	57	11.80	38.24715	21.62440	24.20	2.3	0.10	1.1	17.2	5
2008	OCT	12	10	26	24.70	37.57315	20.49244	29.30	1.6	0.13	0.7	0.9	4
2008	OCT	12	10	26	25.90	37.60568	20.58720	20.30	1.6	0.06	1.2	0.9	4
2008	OCT	12	10	26	26.70	37.66415	20.36481	20.30	2.1	0.13	0.9	1.1	4
2008	OCT	12	11	27	15.10	37.65841	20.61258	17.30	2.3	0.06	2.1	2.0	4
2008	OCT	12	11	27	26.90	37.65451	20.55404	17.30	1.4	0.06	1.1	3.8	4
2008	OCT	12	11	27	26.90	37.63095	20.62134	15.30	2.0	0.07	0.9	1.1	4
2008	OCT	12	11	27	27.40	37.29744	21.20118	27.30	1.6	0.09	2.2	1.1	4
2008	OCT	12	13	57	02.20	37.99361	21.57986	14.20	1.5	0.87	4.0	37.3	4
2008	OCT	12	23	03	25.70	37.02131	21.06228	10.10	1.6	0.27	1.3	1.3	5
2008	OCT	12	23	59	59.40	37.58240	20.98591	26.90	2.2	0.09	2.7	1.0	5
2008	OCT	13	05	07	43.20	37.53175	20.55292	25.50	1.4	0.07	1.0	9.8	4
2008	OCT	13	06	01	21.80	38.06684	21.31629	45.00	1.8	0.17	1.3	2.9	4
2008	OCT	13	06	24	50.90	37.55875	20.65013	8.50	2.3	0.11	1.0	2.2	4
2008	OCT	13	10	40	22.20	37.79865	21.38975	4.30	2.0	0.11	0.8	2.2	5
2008	OCT	13	11	28	27.90	37.26129	21.27594	23.40	1.6	0.11	1.1	1.8	4
2008	OCT	13	13	35	16.80	38.35896	22.29177	15.30	1.9	0.15	1.2	24.2	4
2008	OCT	13	13	37	09.50	38.31524	22.28416	12.80	2.2	0.18	1.0	4.3	5
2008	OCT	13	13	38	25.90	37.67445	22.43706	42.60	2.5	0.22	0.7	18.0	4
2008	OCT	13	14	50	24.10	37.91306	20.97223	11.60	2.8	0.11	1.3	1.0	5
2008	OCT	13	19	27	51.20	38.05286	21.53922	18.30	2.3	0.39	9.5	16.4	4
2008	OCT	13	20	51	51.30	37.49117	20.85236	12.80	1.8	0.08	0.8	1.2	4
2008	OCT	13	21	36	46.90	38.18394	22.08585	12.70	1.1	0.35	1.3	1.9	4
2008	OCT	13	21	54	53.40	37.24465	20.87956	16.80	2.0	0.08	1.0	1.3	5
2008	OCT	13	22	19	04.20	38.06984	21.56770	17.20	1.5	0.11	1.2	2.0	5
2008	OCT	13	22	45	54.20	38.24629	20.53395	6.50	2.4	0.12	1.1	4.7	4
2008	OCT	13	23	48	00.00	38.35022	21.96868	7.50	2.2	0.28	1.9	5.5	4
2008	OCT	14	06	27	32.90	38.32949	22.35256	10.80	1.9	0.11	0.9	11.7	4
2008	OCT	14	09	07	48.80	37.44344	20.49294	5.00	2.6	0.15	0.8	2.9	4
2008	OCT	14	12	30	27.10	37.75894	20.22818	18.40	1.6	0.12	0.6	1.9	4
2008	OCT	14	12	30	28.40	37.24140	21.30497	25.40	1.6	0.11	1.1	1.0	4

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	OCT	14	12	30	28.50	37.19890	21.36273	18.40	1.6	0.18	1.0	1.5	4
2008	OCT	14	13	31	28.60	37.68229	20.37216	21.40	2.5	0.07	1.0	1.7	4
2008	OCT	14	19	48	49.10	37.01846	20.87383	17.70	1.7	0.09	1.2	1.4	4
2008	OCT	15	01	16	47.50	36.77784	21.25037	10.00	2.3	0.11	1.8	1.2	4
2008	OCT	15	12	36	19.80	38.08403	21.59584	10.80	2.2	0.49	3.4	13.8	4
2008	OCT	15	13	32	29.30	37.69361	20.34306	22.40	1.4	0.16	1.2	2.3	4
2008	OCT	15	13	32	29.60	37.07494	21.54188	28.40	1.6	0.10	0.7	1.4	4
2008	OCT	15	13	33	30.30	37.01471	21.56189	17.40	1.7	0.10	0.8	0.7	5
2008	OCT	15	13	33	30.60	37.23900	21.62797	11.50	1.5	0.10	1.1	9.6	4
2008	OCT	15	13	33	30.90	37.27467	21.57635	19.50	1.6	0.44	1.1	2.4	5
2008	OCT	15	13	52	02.10	38.08366	21.62722	14.50	1.8	0.19	2.7	2.9	4
2008	OCT	15	20	51	51.10	37.19538	20.86030	11.80	1.8	0.10	1.3	0.6	4
2008	OCT	16	03	02	28.90	37.65625	20.90628	11.20	1.5	0.10	1.0	1.8	4
2008	OCT	16	07	16	41.80	36.75914	21.05705	9.90	3.6	0.22	1.4	0.7	5
2008	OCT	16	13	28	58.60	37.95962	21.50589	22.20	1.8	0.15	2.8	2.8	4
2008	OCT	16	13	29	00.00	37.95963	21.60126	8.50	2.8	0.29	1.3	0.9	5
2008	OCT	16	14	34	30.20	37.60610	20.58321	13.50	1.7	0.07	1.4	1.1	4
2008	OCT	16	20	38	12.50	37.96055	21.58752	21.20	1.3	0.10	1.0	1.9	4
2008	OCT	16	23	41	28.90	37.62443	22.35005	4.20	1.6	0.10	1.2	22.3	4
2008	OCT	17	06	32	52.50	36.88947	21.58986	13.20	2.3	0.26	2.0	1.8	4
2008	OCT	17	10	45	05.80	37.59077	21.94003	5.70	1.9	0.11	2.0	3.6	4
2008	OCT	17	14	34	31.70	37.37675	20.59967	15.50	1.8	0.16	0.8	1.1	4
2008	OCT	17	14	35	32.30	37.21866	21.58924	15.50	1.7	0.17	1.9	2.4	4
2008	OCT	17	14	36	33.10	37.46905	20.70452	20.50	1.7	0.12	0.8	1.0	4
2008	OCT	17	14	36	33.40	37.52537	20.71617	23.50	1.5	0.07	7.9	5.6	4
2008	OCT	17	14	36	34.70	37.37755	20.67627	27.50	1.7	0.15	0.6	1.0	4
2008	OCT	17	15	03	56.80	37.98119	21.26572	23.20	2.0	0.27	1.5	4.8	5
2008	OCT	17	15	37	34.80	37.02793	21.63433	20.50	1.5	0.09	1.8	1.0	4
2008	OCT	17	15	59	58.00	38.11998	21.67906	17.10	1.6	0.32	1.8	6.5	4
2008	OCT	17	16	33	32.70	37.41790	22.08378	18.90	1.6	0.17	1.1	2.4	5
2008	OCT	17	17	14	15.50	38.32522	22.26447	11.90	1.9	0.26	7.4	2.8	5
2008	OCT	17	20	28	10.80	38.09171	21.33734	14.90	1.5	0.23	1.8	1.1	4
2008	OCT	18	05	56	30.20	37.95435	22.00031	7.50	1.2	0.13	1.0	1.9	4
2008	OCT	18	09	15	57.70	37.74184	21.38080	12.80	1.8	0.11	0.5	1.4	4
2008	OCT	18	15	38	34.60	37.46035	20.66195	21.50	2.1	0.14	0.7	1.2	4
2008	OCT	18	15	38	35.80	37.58048	20.66007	19.50	1.4	0.16	0.8	7.9	4
2008	OCT	18	15	40	36.10	37.19559	21.66556	18.60	1.6	0.20	1.0	1.2	4
2008	OCT	18	15	40	36.40	37.21859	21.66272	19.60	2.1	0.15	1.2	12.2	4
2008	OCT	18	15	40	37.70	37.26791	21.74376	24.60	1.7	0.13	1.1	2.5	4
2008	OCT	18	15	41	37.90	37.79300	20.67626	20.60	1.7	0.14	0.8	1.0	4

Year	Mo	Da	Hr	Min	Sec	Lat (°N)	Lon (°E)	Depth	ML	RMS	SEH	SEZ	Num
2008	OCT	18	15	41	38.30	37.49490	20.66718	22.60	1.7	0.05	0.8	1.0	5
2008	OCT	18	21	54	52.90	36.86443	21.35842	23.50	1.5	0.24	1.5	1.6	5
2008	OCT	19	02	46	58.20	38.03186	22.02999	3.60	2.6	0.12	1.2	12.5	4
2008	OCT	19	09	52	25.10	38.02192	22.02033	8.50	1.9	0.17	1.1	3.7	4
2008	OCT	19	15	42	14.20	37.61555	20.76337	24.60	1.7	0.12	0.5	1.0	4
2008	OCT	19	15	42	39.20	37.66584	20.72974	21.60	1.7	0.06	0.9	1.0	4
2008	OCT	19	16	42	40.10	37.65632	20.69454	21.60	1.4	0.13	0.8	8.2	4
2008	OCT	19	16	42	40.50	37.48915	20.73175	21.60	1.6	0.07	1.1	7.0	4
2008	OCT	19	16	44	41.80	37.81741	20.73764	22.60	2.3	0.21	2.0	16.4	4
2008	OCT	19	16	44	42.40	37.58675	20.77747	22.60	2.3	0.16	0.7	1.4	4
2008	OCT	19	17	16	57.10	38.05400	21.56553	18.20	1.7	0.23	1.3	2.5	4
2008	OCT	19	19	24	49.10	38.04889	21.92619	5.90	1.5	0.29	1.6	25.8	4
2008	OCT	19	22	29	11.80	38.09202	21.64016	16.50	1.4	0.28	1.9	2.0	4
2008	OCT	19	23	49	46.80	38.21835	20.26102	9.80	3.7	0.10	1.5	16.6	4
2008	OCT	20	01	12	17.50	38.00740	21.96611	5.70	1.5	0.22	1.1	2.0	5
2008	OCT	20	05	03	50.20	38.13583	21.62829	15.80	1.6	0.13	1.0	11.7	4
2008	OCT	20	13	09	56.10	38.12949	21.67382	14.60	2.4	0.10	1.3	17.4	4
2008	OCT	20	13	42	05.50	38.17802	20.39778	4.20	2.5	0.29	4.0	19.1	4
2008	OCT	20	15	42	27.30	38.04952	21.62243	20.50	3.0	0.41	1.4	1.1	4
2008	OCT	20	17	45	44.60	37.10000	20.74245	22.70	1.5	0.10	1.4	0.8	4
2008	OCT	20	17	46	45.20	37.04829	21.79456	15.70	1.6	0.20	0.9	1.2	5
2008	OCT	20	17	46	46.20	37.59158	20.72813	15.70	1.7	0.06	0.9	1.0	5
2008	OCT	20	18	46	46.40	37.59460	20.80932	20.70	2.1	0.08	5.6	5.4	5
2008	OCT	20	18	46	46.70	36.97759	20.75474	24.70	1.7	0.25	2.2	1.8	4
2008	OCT	20	18	47	13.70	37.32706	21.82994	21.70	1.6	0.15	4.3	7.0	4
2008	OCT	20	18	48	13.90	37.54337	20.63004	22.70	1.5	0.05	0.8	7.2	4
2008	OCT	20	18	48	46.60	37.62442	20.81904	13.70	1.4	0.08	1.7	8.2	5
2008	OCT	20	20	00	53.80	37.85081	21.81643	21.60	2.7	0.30	1.2	1.6	4
2008	OCT	20	23	31	45.10	38.31822	21.69798	37.10	3.1	0.15	1.1	14.3	5
2008	OCT	21	00	28	26.70	38.37389	21.77541	2.90	1.5	0.19	0.8	18.0	5
2008	OCT	21	02	05	13.70	38.12166	21.60030	8.30	1.5	0.25	1.5	2.1	4